Level 3 Project Plan for:
Open Water Sampling in Western Lake Erie

Prepared by
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Prepared for
Ohio EPA

1. Approvals signatures*

Dr. Thomas. B. Bridgeman, Principal Investigator, U. Toledo  Date: 8/8/2018
Dr. Justin Chaffin, Principal Investigator, The Ohio State University Stone Laboratory  Date: 8/8/2018
Dr. Timothy Davis, Principal Investigator, Bowling Green State University  Date: 8/8/2018

*In signing above, each Principal Investigator (Data collector) attests that he has not been convicted of or pleaded guilty to a violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Attest to make available any and all sampling location information.

Attest to keep a digital photo catalog of all sampling locations will be maintained for 10 years and will include photos of the specific sampling location(s)

2. Table of Contents

3. Distribution List

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4. Project/Task Organization

Water Sampling Coordinators: Dr. Thomas Bridgeman, Dr. Justin Chaffin, and Dr. Timothy Davis will serve as the overall coordinators of the scientific aspects of this project including supervising the efforts of the lake sampling personnel and the exchange of samples from field collection to OEPA.

Lab logistics and chain of custody: Brenda Snyder will be in charge of supplies, sample storage, chain of custody, and transfer to OEPA on behalf of Dr. Bridgeman. At OSU, Dr. Chaffin will be in charge of supplies, sample storage, chain of custody, and transfer to OEPA. At BGSU, Dr. Davis will be in charge of supplies, sample storage, chain of custody, and transfer to OEPA

EPA QA Coordinator: Jeff Reynolds, Ohio EPA, will review QAPP for completeness.

Project Officer: Marianne Piekutowski, Ohio EPA, will ensure that all contractual issues are addressed as work is performed on this task.

Technical Contact: Paul Gledhill, Ohio EPA, will provide overall project/program oversight for this study. He will ensure technical quality throughout the project. He will also ensure that contract objectives are adhered to. He will review and approve the final project report.

5. Problem Definition/Background

It is widely acknowledged that the open waters of western Lake Erie have been increasingly impacted by harmful algal blooms (HABs) over the past 15 years. Adverse effects take the form of potentially dangerous levels of algal toxins that threaten drinking water supplies and prevent recreational use. In addition, unsightly surface scums of algae ruin the aesthetic beauty of the lake, deter tourism and ultimately harm the lakeshore economy. Despite the self-evident problems caused by HABs over large expanses of the Lake, to date there are no objective criteria to determine whether the open waters of Lake Erie are officially "Impaired" and whether conditions are improving or deteriorating. Therefore, the primary objective addressed here is to assist OEPA in the **development of sampling protocols and sample collection to determine listing criteria that Ohio EPA may use to determine when the open waters of the western basin of Lake Erie are "Impaired" and when they are "Unimpaired".**

6. Project / Task Description

In order to assist OEPA in the development of sampling protocols and sample collection to determine listing criteria, UT, OSU, and BGSU will collect lake water samples that will be analyzed by OEPA's laboratory for chlorophyll *a* concentration and microcystin toxin concentrations. Samples will be collected on a weekly basis (as weather and research vessel schedule commitments permit) from August 2017 through October 2017 by UT and OSU, and biweekly by BGSU. Sample sites were selected in consultation with OEPA to represent the Ohio open waters of Lake Erie and Sandusky Bay (Figure 1). Three sites in Lucas Co. waters will be sampled by UT. Four sites in Ottawa Co. will be sampled by OSU, and 4 sites in Sandusky Bay will be sampled by BGSU. Samples for chlorophyll and microcystin will be collected by OSU, UT, and BGSU in a manner that is consistent with OEPA procedures (see section 7). Samples will be processed, stabilized, and stored in an appropriate manner until they can be picked up or delivered to OEPA. Chain of custody, time-date-site information and any other important meta-data will also be transferred to OEPA.

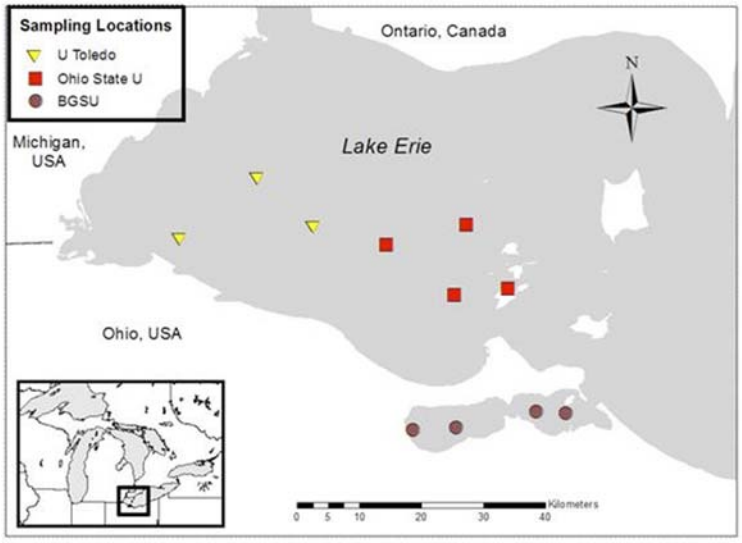

Figure 1. Sites for weekly chlorophyll and microcystin sample by University of Toledo (yellow), Ohio State University Stone Lab (red), and Bowling Green State University (brown) August-October 2017.

7. Data Quality Objectives & Criteria

The overall quality assurance objective for this project is to acquire, process, store and transfer water samples from Lake Erie to OEPA in a manner that is consistent between UT, OSU, BGSU, and OEPA and is compatible with established OEPA procedures. The quality objectives will be met by OSU, UT, and BGSU following the procedures described in Section 10, by supervision and training of sample collectors, and providing chain of custody and other sample metadata. Quality of samples transferred to OEPA will be verified through the collection and transfer of duplicate samples (5% of samples) and DI water blanks (5% of samples).

8. Special Training/Certification

OEPA procedures recommend that a Level 3 QDC (Quality Data Collector) be responsible for the collection of water samples for chemical analyses. Drs. Chaffin, Bridgeman, and Davis have Level 3 QDC status, but it is not possible for them to participate in every weekly boat trip to collect samples. Therefore, UT, OSU, and BGSU sampling trips will involve students and technicians who are trained in sample collection but are not QDC3. Non-QDC3 students and technicians will be deemed qualified to collect OEPA samples (for this project only) after they and the QDC project managers have completed the following requirements:

- A thorough review of the Project Study Plan and the sampling locations prior to any sample collection activities. Each sample site will be visited once before sampling by both the Level 3 QDC project manager and any non-level 3 QDC sample collectors.

• A thorough review of all relevant Standard Operating Procedures by the Level 3 QDC project manager with any non-level 3 QDC sample collectors prior to any sample collection activities

• Training of the non-level 3 QDCs by the Level 3 QDC project manager in the use of all sampling equipment, including, but not limited to, the YSI data sondes and current meter, prior to any sample collection activities. One training will be conducted in the office and one in the field.

• Direct supervision by the Level 3 QDC project manager of the individual's initial sample collection activities during the first sample round to ensure compliance with the SOPs and Study Plan.

• The Level 3 QDC will also perform a subsequent field audit of non-QDC personnel performing sample collection activities once during the sampling season.

All training and certification records are maintained by the participant's home institution (Section 16).

9. Documents and Records

UT, BGSU and OSU will both record sampling data in notebooks carried on each sampling trip. Field notes will record sampling date, time, location, depth of sample, volume of water filtered, sample bottle number and any noteworthy observations of lake conditions. Chain of custody records and field notes will be transferred to OEPA with copies maintained in OSU and UT laboratories.

Digital photo catalog of all sampling locations will be maintained for ten years including photos of the specific sampling location, riparian zone adjacent to the sampling location (if applicable), and general land use in the immediate vicinity of the sampling location (if applicable).

10. Sampling Process Design and Methods

Weekly procedures and equipment for the collection of chlorophyll and microcystin toxin samples are as follows for both OSU and UT: The research vessel will be deemed to be 'on site' when it arrives to within 50 m of the GPS coordinates established for that site. When the vessel is stationary on site, sampling will commence. All sample equipment will be rinsed with sample water. Water sampling procedures and equipment are intended to collect an 'integrated water column' sample - a vertical 'plug' of water representing all depths from the surface to approximately 1-2 m above the lake sediments. This is accomplished using a flexible tube sampler. The sampler consists of a length of clear PVC (Vinyl) tubing of 1 inch (2.5 cm) inner diameter, 1.25 outer diameter. A 5 lb weight is attached to the lower end of the sampler so that the tube goes straight down into the water (Figure 2). The upper end may be closed with a rubber stopper or valve (Figure 2). With the top end open to allow air to escape, the bottom end is lowered into the water and the tube

descends vertically at a rate not to exceed 1 ft/s, taking care that there are no kinks in the tube, until the top of the tube is just above the water surface. At this point, the top of the tube is stoppered (or valve closed) to prevent water from exiting the tube. The tube is then withdrawn from the water and the bottom of the tube is placed in a clean sampling bucket. (The bucket is used only for sampling lake water and is prepared by rinsing with DI water and allowed to drain thoroughly). The stopper is removed from the top of the tube (or valve opened) and the tub is allowed to drain completely into the bucket.

Sample bottles are filled by using gloved hands to lower a funnel (previously rinsed with DI and drained) into the bucket to thoroughly mix the bucket contents and scoop up water. Water from the funnel is drained into samples bottles, first for a rinse and discard, and then for final filling. For microcystin samples, clean PETG plastic (supplied by OEPA) are filled to 100 ml. For chlorophyll *a* samples, pre-cleaned (acid washed, DI rinsed) HDPE or polycarbonate bottles are filled to 1-2 liters. Labeled sample bottles are immediately placed on ice in closed ice chests for transport to the laboratory.

Sampling procedures for BGSU in Sandusky Bay are the same as described above except that a Niskin sampler will be used in place of a vertical tube sampler because of the shallow depth and mixed nature of the Bay. The Niskin sampler will be lowered into the water for a rinse, then lowered again to a depth just below the surface. The sampler mechanism is triggered to close the bottle and the water sample is retrieved. Sample bottles are rinsed and filled directly from the Niskin sampler.

Upon return to the laboratory, microcystin samples are placed in a -20 C freezer. Chlorophyll samples are processed by thoroughly shaking the sample bottle and then filtering 100-500 ml of sample onto to GFC filters (supplied by OEPA). The volume of sample filtered may depend on the density of algae in the sample and filtered volumes are recorded on data sheets and on filter storage containers. Filters are folded into quarters (algae side inward) placed into labeled aluminum foil sleeves and stored at -20 C. If storage time prior to transfer to OEPA is to exceed 2 weeks, samples will be transferred to storage in a -80 C freezer.

11. Sample Handling and Custody

All water samples will be stabilized immediately after collection as described above and stored prior to analysis for as brief a period as possible. Algal toxin samples are considered to be stable when stored at -20 C in the dark. Chlorophyll filters are considered to be stable for 1-2 months at -20 C, and indefinitely when stored at -80 C. Chain of custody forms provided by OEPA will be used to track collection, processing, storage and transfer of samples to OEPA. Labels on the form will be checked against labels on sample containers to assure that all date/site data is present and that processing, and storage time is accounted for. Samples will remain in the direct control of the samplers or in a locked, secure location until delivery of the samples can be successfully made to Ohio EPA

12. Analytical Methods

All sample analyses will take place after transfer of samples to OEPA using OEPA procedures and methods.

13. Quality Control

Real-time QC procedures for water collection consist of visual confirmation that sampling tubes have been deployed correctly, that samples are transferred to clean, rinsed, correctly-labeled containers, and

the samples have been stabilized. **Field duplicates** and **field replicates** will be collected and submitted to OEPA at a minimum frequency of 5% of the total number field samples. Likewise, field blanks will comprise 5% of the samples. Field Duplicates (also known as Field Split) is done by thoroughly mixing one sample and dividing it into two separate sets of containers. Field duplicates will be labeled "Duplicate" and submitted blind to OEPA. A field replicate is done by collecting separate samples from the same site at approximately the same time using the same sampling method. Field replicates will be labeled "Replicate" and submitted blind to OEPA. Field blanks are done by rinsing the samplers and sample bottles with deionized (DI) water, and then the sampler is filled a second time with DI water and discharged into the bucket. Sample bottles are filled from the bucket, processed and stored according to the chlorophyll and toxins analyses described previously. Field blanks will be labeled "Field Blank." Laboratory analysis QC procedures will be the responsibility of OEPA lab analysts.

14. Data Management

All field data will be recorded on standard field data forms designed by the PIs. Field data include date, time, and location of sample collection, volume of water filtered, name of collector, weather conditions, and notes on any conditions that could be of interest or could affect the sampling outcome. Field data forms will be transferred to OEPA with copies stored in binders at the collectors' laboratory for safekeeping and later reference. Most field data will appear on the sample bottles and foil filter packets, but if other noteworthy observations are made these will be included on the data forms provided to OEPA.

15. Reports to Management

The individual PIs will report the status of their project components to the Project Manager and other PIs during conference calls to be held 1 month prior to the beginning of the field season, mid-field season, and at the close of the field season. On each call, each PI will report on progress of their aspect of the research including data quality assessments and any significant problems. Frequent contacts will also be made during the field season to arrange sample transfer.

16. Training Documentation

Training Documentation of non-QDC

The following individual has 3 months experience collecting water samples under a level 3 Qualified Data Collectors (QDC), has read and agreed to follow the procedures described in this QAPP, and successfully verbally recited the collection and processing procedures described in this QAPP. This document provides written record this individual was trained by a QDC.

By signing below, the trainee also certifies that that he or she has not been convicted of or pleaded guilty to a violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Name of trainee: _____

Start date of training with a QDC: _____

Date this QAPP was read and agreed upon: _____

Date that methods in this QAPP were successfully recited: _____

Trainee Signature: _____

QDC Signature: _____

Literature Cited

Ohio EPA. 2018. "Surface Water Field Sampling Manual for water quality parameters and flows. Ohio Environmental Protection Agency, Division of Surface Water / Division of Environmental Services. Columbus, Ohio. 39 p."

Ohio EPA. 2018. "Surface Water Field Sampling Manual – Appendix II. Columbus, Ohio. 31 p."

Ohio EPA. 2018. "Surface Water Field Sampling Manual – Appendix IV. Columbus, Ohio. 53 p."